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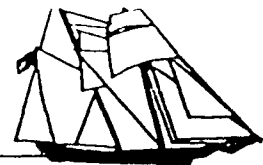
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SCSC-1991

Baltimore, Maryland July 22nd - 24th



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M.I.T. Lincoln Laboratory
244 Wood Street
Lexington, MA 02173

12 March 1991

Mr. or Ms. Attendee
DARPA/PM TRADE 4th Workshop
Interoperability of Defense Simulations
Orlando Marriott FL 32816

Dear Colleague,

The purpose of this letter is invite your to attend the 1991 Summer Computer Simulation Conference (SCSC-91). SCSC-91 will be held at the Hyatt Regency Hotel in Baltimore, MD on July 22-24, 1991. The Conference will be divided into sixteen groups of parallel sessions covering a spectrum of topics as outlined below, also see attached "Call for Papers."

Table 1) SCSC-91 Program	
Group	Group Name or Simulation Topic
1	Simulation Methodologies
2	Computer Performance & Advanced Processing
3	Intelligent Simulation Environments
4	AI & KBS in Simulation
5	Communications & Radar Systems
6	Engineering Applications
7	Biomedical Systems
8	Undersea Systems
9	Missile Systems
10	Aerospace Simulation
11	Strategic Defense Initiative
12	Simulators & Simulation Use in Training
13	Government, Management & Social Science
14	Robotics & CAD/CAE/CAM
15	Frontiers of Simulation in Asia
16	Environmental Modeling



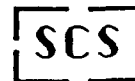
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More specifically, I want to draw your attention to the advanced Program for Group 12, which I am cochairing. The objective of Group 12 is to report new results and discuss key issues and trends in "Simulators & Simulation Use in Training."

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FORCE ON FORCE TRAINING IN THE UNITED STATES NAVY

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ABSTRACT

Schools can teach our men how to operate equipments; only their commanders can teach them how to fight and that has to be on their own ships, with their own leaders and their own equipments, supported by a tactical scenario that reflects the urgency of their real world missions." (VADM Mustin 1986)

This statement set the stage for Navy force on force training. There are two conditions that the Navy must address in achieving advanced warfighting training. First, the Navy has invested heavily in embedded but traditionally stand alone training devices and must capitalize on these previous investments. Second, there is an overwhelming need for realistic dynamic opposition forces.

The need to develop an advanced interoperable tactical training environment in which to exercise force on force training in the United States Navy has never been greater.

BASIC AND UNIT TRAINING

After basic training, crews are assembled in shore based trainers to learn internal unit teamwork. These shore based trainers also allow for the individual units to practice as multi-unit teams against pre-scripted scenarios created by instructors.

C3 TRAINING

C3 Training is currently achieved in modules. Command Post Exercises focus on the planning aspects of warfare. Follow on War Games provide strategic decision making training for battle group staffs and fleet commanders. At the tactical level, shipboard crews and some staffs move aboard ships and practice battle group training on their actual equipments. Well planned pre-scripted scenarios are transmitted to the ships. While these BATTLEX'S have been very useful prior to getting underway, exercise execution has been limited in dynamics and thus limited in realism.

Shipboard BATTLEX'S In The '60's

When the Naval Tactical Data System (NTDS) was developed in the 1960's, it embedded training stimuli messages in the operational connectivity data stream. In a BATTLEX these messages were and still are today transmitted to the ship via radio waves.

The governing scenario (Orange Force) is pre-scripted by the Tactical Advanced Combat Direction and Electronic Warfare (TACDEW) Master Simulation Program (MSP) at the Fleet Combat Training Centers. The ship receives the Link-11 messages and routes the stimuli messages to an onboard embedded training stimulator called the Video Signals Simulator (VSS). The VSS creates a radar return presentation on the radar scopes.

With the operators now stimulated, they take console button action to initiate track information. This is processed locally by their tactical computers and transmitted as Link-11 operational messages to other participating Blue Force units. The upper level decision makers react to the information that is presented to them via Link-11 on their NTDS system.

To recap, Orange Forces as far back as the 1960's have been pre-scripted, transmitted, and routed to a shipboard embedded radar stimulator. The simulated track information has been transmitted as overhead in operational Link-11 message traffic. Blue responds with button action and coordinates with other Blue units via Link-11 and voice. The fight has always been one way: Orange stimulate; Blue respond.

In The '70's

In the seventies the Navy added to its inventory of inport training devices the 20B4 and 20B5 pierside trainers. The 20B4 is a single ship multi-radar stimulation device. The 20B5 is a single ship full combat system stimulation device for the FFG-7 class ship.

They are housed in a semi-truck which parks on the pier

and extends cables to the ship undergoing training. Exercises have been run in which the TACDEW scenario is manually time synchronized with the 20B4 / 20B5 scenario. While Blue Forces are connected via Link-11 the Orange Forces are linked only by voice communication for coordination of start times for the pre-scripted scenarios.

In The 80'S

In the eighties the Navy added Electronic Warfare (EW) training tapes for onboard training. As single ship stimulation devices they have functioned very well in providing single unit operator proficiency training. At times, these too have been used in BATTLEX's by time synchronizing the scenario start time of TACDEW and 20B4/20B5 with EW tapes.

Manual Time Synchronization: As might be expected, the time required to create an exercise of battle group proportions where the stimulation devices and mediums are connected only by "start the problem / start the clock" voice commands takes weeks, often months to develop. Only the smallest of changes can be accommodated by Orange (TACDEW, 20B4/20B5, EW Tapes) once the problem begins. Manual time synchronized scenarios offer good training drills.

Next Generation Stimulation Devices: Also during the eighties, as the threat increased in complexity the Navy responded with newer sensors and weapons. The New Threat Upgrade (NTU) program and the AEGIS program are examples. With these new systems came new embedded training devices.

NTU brought with it the Radar Environmental Simulation System (RESS). RESS replaced the VSS on ships receiving the NTU upgrade package. The radar presentations are more realistic, jamming and land mass creation has been greatly enhanced.

The AEGIS program developed the AEGIS Combat Training System (ACTS). A fundamental part of ACTS is the Test Target Generator in the SPY-1 phased array radar.

However the connectivity path between the VSS, RESS, ACTS, TACDEW, and 20B4/20B5 remains the training messages embedded as overhead in the operational Link-11 message traffic. The training message connectivity path remains one way - from a master scenario generator to remote embedded stimulation devices.

The 90'S

As the eighties rolled into the nineties the SQQ89 Onboard Trainer (OBT) began to be fielded in numbers. The SQQ89 OBT is a stand alone acoustic stimulator for the AEGIS, FFG-7, and DD-963 ship classes. An upgrade to enable the SQQ89 OBT to stimulate Electronic Warfare suites is underway.

LIMITATIONS OF STIMULATORS

In order to satisfy the emerging requirements for battle group / battle group training in terms of the number of simulated tracks and for a dynamic interactive training environment, continuing to rely on the embedded training stimuli messages in Link-11 will not achieve the end goal for true force on force training.

The scope has expanded from just a few radar tracks in the '60's to thousands of tracks in the warfare areas of Anti-Air Warfare, Anti-Submarine Warfare, Anti-Surface Warfare, and related combat situations.

The data rates and bandwidths required for the volume and complexity of creating a realistic Orange force is beyond the capacities of '60's technology.

NEW CONCEPT IN TRAINING

The concept of Orange Forces stimulating Blue Forces who in turn respond with appropriate action is adequate for intermediate levels of team training. It is, however, inadequate for advanced C3 warfighting training.

Advanced training requires force on force interaction. It requires an environment in which Orange can stimulate, Blue respond, but then will allow Orange to change its initial conditions and modify their game plans as the fight unfolds. Man in the loop simulation is absolutely required.

SIMULATION NETWORK

The "how to" appears obvious. Many embedded training devices have been fielded and upgrades continue to be implemented. Linking the computer to computer stimulation devices via a simulation network can create the interactive environment.

The simulation network, sometimes referred to as a training link in the Navy, would become the C3 network for Orange, just as Link-11 is the C3 network for Blue on their operational equipments. As Link-11 is supple-

mented by Link-16 and Officer in Tactical Command Information Exchange (OTCIXS) networks Blue increases its C3 capabilities. Similarly Orange can and will increase the complexity and content of its simulation network as the development of the interactive environment evolves.

SEMI-AUTOMATED AND AUTOMATED FORCES

Because not all battle group and battle force exercises may have all the players available to participate at one time, there is a need for semi-automated forces for both Blue and Orange. Blue semi-automated forces would send their traffic via the simulation network as well as via Link-11, Link-16, and OTCIXS networks.

Use of automated forces must be carefully integrated. Pre-scripted scenarios must be avoided, so automated forces must have significant artificial intelligence built into them.

SUMMARY

The requirement for force on force training is well founded in the Navy. Significant simulation systems have been fielded as stand alone capabilities. The challenge is to integrate these existing and developing training systems into one advanced interoperable tactical training environment via a simulation network. The

existing operational data links, such as Link-11, will remain for those forces that man their own equipments as their battle stations. A dynamic interactive - Blue Force versus Orange Force - where freeplay is the norm, is the key to achieving realistic advanced C3 training.

Figure 1 illustrates the concept of force on force training in the United States Navy.

REFERENCES

Mustin, VADM H. C. 1986. "Maritime Strategy from the Deckplates." *U.S. Naval Institute Proceedings*, Volume 112/9/1003, (Sep.): 33-37.

BIOGRAPHY

Mr. Thomas R. Tiernan is a Senior Systems Engineer in the Command Control Department, Systems Integration and Readiness Systems Branch, at the Naval Ocean Systems Center, San Diego, California. Mr. Tiernan has Bachelor of Science Industrial Engineering degree from Purdue University, 1974, and a Masters in Business Administration with a concentration in Information Systems from San Diego State University, 1988. He served in the Navy as an officer for five and a half years and worked in industry for four years before joining the Naval Ocean Systems Center in 1983. Mr. Tiernan is the Technical Direction Agent for the Navy's Battle Force Tactical Training Program.

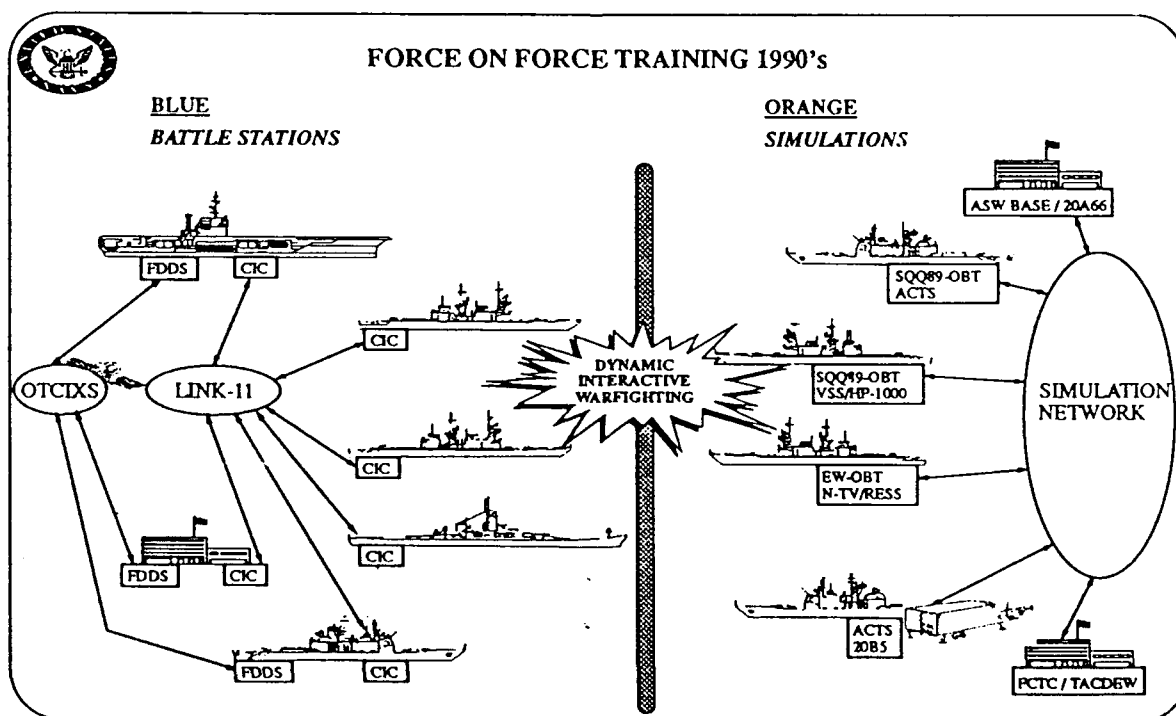


Figure 1.